Peculiarities of deep water distribution in the Middle Adriatic Sea

by

LEOPOLDO TROTTI
Istituto sperimentale talassografico, Trieste (Italie)

Notwithstanding the many cruises carried out in the Adriatic, our knowledge regarding the peculiarities of deep water distribution is, as yet, extremely limited, due principally to the lack of data for cruises held consecutively in autumn and winter. With this in mind, we carried out three cruises (ship *Bannock* - C.N.R.) the first in November/December 1965, followed by another in February 1966 and the third in September of the same year. The first two showed peculiarities which are now briefly reviewed, but this report is to be considered as only a preliminary to a full-scale work covering all the data collected during the three cruises.

As has been described in an earlier publication [*Atlante dei Batitermogrammi Mare Adriatico, Crociere* 1965-1966. — L. TROTTI, 1966] the survey area was limited in the north by a line running from the Pô Estuary to Istria, and another in the south from the Gargano Peninsula to Meleda Island. Between these borders there were 7 hydrological sections, totalling 74 stations, and this narrow net enabled us to obtain substantial hydrological records. The present report is confined to data concerning the Fossa Mesoadriatica and the central trench which, leading southward and connecting with the Ionian Sea, is bordered by the two continental shelves.

The Mesoadriatic Deep is characterized by three depressions — Zirje, Jabuka and Ortona, their respective depths being 239 m, 270 m and 256 m — and northward it merges into a slope that reaches the continental shelf of the North Adriatic.

Hydrologically, the Adriatic Sea may be divided into different masses of water — North Adriatic (T — 11.0, S ‰ — 38.5, σ_t - 29.52), Central Adriatic (T° 12.0, S°/$_{oo}$ 38.2, σ_t 29.09), South Adriatic (T° 12.5, S°/$_{oo}$ 38.5, σ_t 29.2) Mediterranean water (14,0, S°/$_{oo}$ 38.7, σ_t 29.06), and this variable distribution of temperature and salinity characterizes a gradient that determines a general inflow of water along the Yugoslavian coast and an outflow along the Italian coast. In autumn, however, this compensating current appears to be broken in a series of cyclonic movements of varying amplitudes, one of these movements falling in the central part of the Adriatic.

From our data, extended to within a few feet of the sea bottom, the presence of deep water can be clearly defined, together with its distribution and variable thickness. In November/December this deep water does not appear at stations 37 and 38 on the section which passes through the Fossa Mesoadriatica, these two stations being the nearest to the Italian coast.

1. In December :

at st.39 (173 m) the thickness of the deep water strata is about 10 m
» st.40 (224 m) » » » » » » » » » 25 m
» st.41 (242 m) » » » » » » » » » 54 m
» st.42 (218 m) » » » » » » » » » 22 m

» st.43 (208 m) the deep water is missing, and it reappears at st.44 (183 m) adjacent to the Yugoslavian coast; here its thickness is reduced to 8 m. Further south, on the hydrological stations located above the trench, the deep water at st. 48 (180 m) is only 6 m thick while at st.50 (174 m) it is 25 m thick, this latter station being the furthest to the east.

Rapp. Comm. int. Mer Médit., **21**, 4, pp. 225-226 (1972).

In February :

on the section crossing the Fossa Mesoadriatica, the thickness of the deep water is as follows :

st.38 (103 m) - 28 m. st. 39 (204 m) - 23 m. st.41 (255 m) - 16 m.
st.42 (225 m) - 14 m. st.43 (216 m) - 21 m.

while at st.40 (208 m) it does not appear. Further south, at sts. 46 (85 m), 47 (143 m) and 50 (182 m) the deep water strata was 10 m, 48 m and 15 m thick, respectively.

In the next section, on st.60 (101 m) and st.61 (121 m) deep water showed a thickness of 8 m and 47 m, respectively.

The most southerly section, i.e. st. 70 (125 m) sited above the trench, showed a deep water thickness of about 8 m.

From the foregoing it would seem that in the three Deeps and along the next hydrological section to the south, the thickness of the deep water strata is, comparatively, higher in December than in February. In the next two southerly sections, there is a complete lack of deep water in December though it manifests itself in February.

2. Comparing the temperature, salinity and density data collected during the two cruises, we have the following ranges :

Fossa Mesoadriatica :

Dec. (sts.39, 40, 41, 42, 44)	11.02 - 11.74	38.27 - 38.34	29.25 - 29.39
mean values	11.42	38.32	29.30
Feb. (sts. 38, 39, 41, 42, 43)	11.00 - 11.50	38.30 - 38.36	29.31 - 29.36
mean values	11.27	38.33	29.33

Southern section above trench :

Dec. (sts. 48 and 50)	11.66 - 11.81	38.28 - 38.37	29.19 - 29.29
mean values	11.73	38.32	29.24
Feb. (sts 47, 50, 60, 61, 70)	11.44 - 12.07	38.34 - 38.47	29.29 - 29.33
mean values	11.73	38.41	29.31

This deep water is easily located by its sharp density gradient, and a mixing phenomenon with the strata immediately above does not appear.

3. In general, oxygen decreases near the bottom to a minimum of 4.2, confirming the stagnant condition of this water mass.

From the foregoing data, it may be concluded that the deep water strata can decrease in thickness also in winter when the inflow of deep water from the northern part of the Adriatic Sea is not strong enough, or else appears only in later data. In our case, as regards the northern section from Rimini to Capo Promontore, we see that stations 8 to 14 show mean values (in February) of 11.0, 38.3, 29.4 but waters characterized by this parameter remain, in this month, limited to the area afore-mentioned.

The difference in maximum height reached by the deep water in the three depressions of the Fossa Mesoadriatica can be explained by the fact that these basins are delimited by sills of varying heights. These sills, however, are so small and irregular that they can easily be ignored in a systematic hydrological survey. The 38 m difference between December and February levels points to an outflow from the Jabuka Deep and it would seem that the sill connecting this depression to the trench should be located at a depth of about 240 m. If this explanation is, in part, acceptable, we must also consider the influence of a strong mixing phenomenon at maximum depth caused by the influx of water masses of a different type.